Astronomy Selection

Carl Sagan's Universe

Eds: Y. Terzian and E. Bilson, Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 2RU, 1997, 282pp, £14.95 (US$22.95) Paperback, £40.00 (US$59.95) Hardback, ISBN 0-521-57286-X.

Carl Sagan carried out significant research in planetary science, was closely associated with the US Space Program, created a highly-acclaimed television series and was author of many popular science books. His many contributions to science and society were profound and far-reaching.

The present volume, issued in his memory, is a collection of articles by some 20 contributors on the science, education, policy-making and related areas in which Sagan worked. It is divided into four sections. The first two provide an overview of the US Space Program, as well as a complementary account of the Russian Programme, and of the history and current status of the search for extraterrestrial life. The remaining two sections deal with the importance of science education to a technical society and the shaping of science policies to tackle problems which face us today.

There is also a separate chapter by Sagan himself which discusses the place and role of our planet and mankind in the Universe.

Molecules in Astrophysics: Probes and Processes

Ed: E.F. Van Dishoeck, Kluwer Academic Publishers, PO Box 989, 3300 AZ Dordrecht, The Netherlands, 1997, 588pp, £126, ISBN 0-7923-4538-X.

Molecules are found in a large variety of astronomical environments, ranging from comets in the Solar System to galaxies at high redshift. This book brings together astronomers, physicists and chemists to discuss the use of molecules as probes in astrophysical parameters, to explore their role in the evolution of astronomical objects and to study the basic chemical processes that occur in space.

The enormous recent progress in observational techniques is illustrated by studies of the physics and chemistry on scales comparable to the protosolar nebula around high and low-mass forming stars and planetary systems. Elegant new experimental techniques for the measurement of gas-phase reactions at low temperatures, the analysis of spectra and the investigation of surface adsorbates on interplanetary dust particles and meteorites are presented and the importance of accurate quantum chemical calculations emphasised.

Our present knowledge of the composition of dust grains and polycyclic aromatic hydrocarbons is summarised. Other topics considered include models and observations of jets and outflows, photo- and X-ray dominated regions, masers in and outside our galaxy, the collision of Comet Shoemaker-Levy 9 with Jupiter, the envelopes and photospheres of late-type stars, including Brown Dwarfs, diffuse and translucent clouds and external galaxies ranging from the nearby Magellanic Clouds to distant quasar absorption line systems and starburst galaxies lying at the edge of the Universe.

Cosmic Winds and the Heliosphere

J.R. Jokipii, C.P. Sonnett & M.S. Giampapa, The University of Arizona Press, 1230 N. Park Avenue, Suite 102, Tucson, Arizona 85719-4140, USA, 1997, 1013pp, $100, ISBN 0-8165-1825-4.

The idea that the Sun emits high-speed particles goes back over a hundred years, beginning with theories about the origin of the aurora and with growing recognition, in the second half of the 19th century, that aurorae and geomagnetic activity were related, both being enhanced during times of increased sunspot activity. However, the precise nature of the coronal heating that provides the solar wind (which accounts for the behaviour of comet tails) is still unclear.

Fifty contributors to this volume present accounts of current research and discoveries in the areas of solar winds, heliospheric shocks, magneto-hydrodynamic turbulence and kinetic phenomena, thus reviewing in detail both varieties of cosmic winds, (referred to as galactic or solar winds), and the physics of their origins and movement.

After an introduction which examines the history of the solar wind concept and types of mass ejecta, three main sections examine studies of the various kinds of winds, the physics of their origin and the physical phenomena involved. A final section considers the effect of cosmic winds on the surrounding interstellar clouds, radio emissions, comets, planets and the solar system generally.

Almost all stars and many, if not all galaxies, eject matter into space, the causes of which range from explosions from the sudden production of heat, the centrifugal ejection from rapidly spinning objects and the gradual acceleration and departure of distant portions of thermal atmospheres. Among the most extreme cases of ejection are the prodigious outputs involved in high-speed jets from radio galaxies, with novae and supernovae also playing their important roles in ejecting heavy elements to the interstellar medium, from which new stars are formed. Besides these, there are winds from cataclysmic variables, from very young stars and from pulsating stars.

Particularly interesting is the description of how the ultraviolet spectral data of nearby stars provides information about the interstellar clouds surrounding the Solar System. Indications are that this flows past the Sun from a position centred in the Norma-Lupas region and has properties consistent with interstellar gas originating as material from the surfaces of stars embedded in the Scorpius-Centaurus Association which were subsequently displaced towards the Sun by a supernova event some 400,000 years ago.

This local interstellar cloud (nicknamed the "Local Fluff") determines the boundary conditions of the heliosphere.

The Universe Unfolding

Eds: H. Bondi & M. Weston-Smith, Oxford University Press, Great Clarendon Street, Oxford, OX2 6DP, 1997, 406pp, £25, ISBN 0-19-851188-4.

This book collects together 20 lectures given by leading astronomers over the last two decades, each of whom addresses his topic from a highly personal viewpoint. This approach brings out any differences in outlook, attitude and style, all of which add to the interest of the volume. The earliest talk is on the well-publicised views of Hoyle on whether comets bring life or death, which appeared in 1977, while the latest discusses the complexity of the Universe as it appeared in 1996. Nearer to home is the lecture by King-Hele describing ideas about the Earth's atmosphere as these appeared around 1984.

The book is stimulating not only for its subject-matter but also for the nature of the views expounded so robustly by each contributor as he homes in on his chosen theme. However, given a 20-year time-spread and the accelerating nature of astronomical studies nowadays, the content has to be viewed more from the nature of an account of major historical contributions to astronomy rather than as one which sets out current state-of-the-art views. Nonetheless, bringing together so many important papers covering so many themes in the one volume has to rank as a unique achievement in itself, for the compendium provides an opportunity to regress once more over many exhilarating stages in the development of astronomical thought with the added advantage of hindsight which enables us to appraise how each of these contributions have since fared.

Science with the VLT Interferometer

Ed: F. Paresce, Springer-Verlag GmbH & Co KG, Tiergartenstrabe 17, D-69121 Heidelberg, Germany, 1997, 404pp, £18.50 (US$29.95), ISBN 3-540-63264-6.

Interferometry can provide a high-angular resolution without having to build telescopes of enormous size. Instead, the aim is reached by combining the light beams received from several small telescopes.

This book examines the first anticipated observations from the introduction of such telescopes which are expected to begin early next century. It describes all the areas which will be seriously studied with the new facility, for optical interferometry is still a somewhat unfamiliar technique for many astronomers.

In the case of the European Southern Observatory, their VLT Interferometer will employ an array of four 8 m and three 1.8 m diameter telescopes, combined to reach unprecedented resolution of a millisecond of arc in the visible/IR for objects as faint as 24th visual magnitude, something which is likely to open up vast new frontiers.

ESO has long had the aim of operating a VLT in an interferometric mode (VLTI) whereby stellar light beams by a number of telescopes can be combined. Already, interferometric projects have begun to play a central role in ground-based high-resolution astronomy. Numerous instruments have now either been completed or in the process of construction, with some exceptionally large aperture interferometers due to come on-line by the turn of the century. A few of the areas due for early study are extra-solar planets, low mass stars and brown dwarfs, "starburst galaxies" and circumstellar environments, among a very extensive list.

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